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Concise Explanation of Relevance: This document is disclosed in the body of a specification along with the statement of relevancy.

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Concise Explanation of Relevance:

[0053] A method of calculating a discharge current waveform Id(t) from the voltage waveform E (t) and the current waveform Is(t) as shown in FIG. 11 will now be described.

[0054] The discharge current waveform Id(t) can be obtained by the formula below, by using the two coefficients: $F=1+C1/C2$ (formula 9); and $Cv = C1+C3 \cdot F$ (formula 10), which are determined by capacitance C1 of the capacitor 12 of the discharge plasma space 2, capacitance C2 of the capacitor 13 of the dielectrics 5 and 6, and a stray capacitance C3 existing parallel to the dielectric barrier discharge lamp.

$$Id(t) = F \cdot Is(t) - Cv \cdot dE(t)/dt \quad \text{(formula 11)}$$

[0055] Since this method uses numerical differentiation, it does not have good accuracy in a small region of a current value, in the waveform obtained. However, since it shows a fast rise in start of discharge, it can be used with no problem as long as it is used for the purpose of finding the rise.

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Title: Discharge Lamp Starting Device and Illumination Apparatus
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Exhibit B

[0056] The following are the analytical conditions and experimental conditions in the case of FIGS. 9, 10 and 11.
C1: 35 pF
C2: 220 pF
C3: 15 pF
Frequency: 30 kHz
Transformer primary inductance: 1.1 mH
Transformer secondary inductance: 630 mH
Transformer coupling coefficient: 0.9993
Dielectric: silica glass – 1 mm thickness
Discharge gas: xenon – 33 kPa pressure
Discharge gap: 4.3 mm

[0057] In FIG. 11, the discharge current waveform Id(t) rises sharply at the time Td. This shows that the time Td is the time when discharge has started. In the voltage waveform E(t), an inflection point K is formed at the point corresponding to the time Td.

[0058] The voltage values Vk, Vb and Vh necessary for calculating the above values Vx and Vy are shown in FIG. 11, and the voltage value Vf is shown in FIG. 9. In this case, Vf has a negative value. Substituting their actual measured values into the (formula 1) yields Vy/Vx = 0.30.

[0059] Another embodiment will now be explained. FIG. 12 is a schematic circuit diagram of a lighting circuit of a dielectric barrier discharge lamp using an inverter circuit of full-wave bridge type. FIG. 13 illustrates actual measured data of the voltage waveform E(t) and the current waveform Is(t) of the dielectric barrier discharge lamp 1 of FIG. 12. FIG. 14 is an enlarged view of the measured data of the section Z roughly shown in FIG. 13. FIG. 15 illustrates the discharge current waveform Id(t) obtained by analyzing the waveforms shown in FIG. 14 with a computer, together with the voltage waveform E(t) and the current waveform Is(t).

[0060] The analytical conditions and experimental conditions in the case of FIGS. 13, 14 and 15 are the same as those in the case of FIGS. 9, 10 and 11, except that the frequency is 21 kHz. In

FIG. 11, around the time Ta1, the discharge current waveform Id(t) has no significant amplitudes, although the voltage waveform E(t) and the current waveform Is(t) have a large amplitude around the time. This shows that no discharge is generated around the time Ta1 under these experimental conditions. There are cases where discharge occurs in the point corresponding to the time Ta1 according to the conditions, even in lighting of the same waveform.

[0061] In FIG. 15, the discharge current waveform Id(t) sharply rises at the time Td. This shows that discharge started at the time Td. In the voltage waveform E(t), an inflection point K is formed at the point corresponding to the time Td.

[0062] The voltage values Vk, Vb and Vh necessary for calculating the values Vx and Vy are shown in FIG. 11, and the voltage value Vf is shown in FIG. 13. In this case, the value Vf is negative. Substituting these actual measured values into the (formula 1) yields Vy/Vx = 0.18.

[0063] Another embodiment will now be explained. FIG. 16 is a schematic circuit diagram of a lighting circuit of a dielectric barrier discharge lamp using a flyback inverter circuit. FIG. 17 illustrates actual measured data of the voltage waveform E(t) and the current waveform Is(t) of the dielectric barrier discharge lamp 1 of FIG. 16. FIG. 18 is an enlarged view of the measured data of the section Z roughly shown in FIG. 17. FIG. 19 illustrates the discharge current waveform Id(t) obtained by analyzing the waveforms shown in FIG. 18 with a computer, together with the voltage waveform E(t) and the current waveform Is(t).

[0064] The following are the analytical conditions and experimental conditions in the case of FIGS. 17, 18 and 19.

C1: 35 pF
C2: 220 pF
C3: 15 pF
Frequency: 36 kkHz

Transformer primary inductance: 33 μ H

Transformer secondary inductance: 6.1 mH

Transformer coupling coefficient: 0.9930
Dielectric: silica glass – 1 mm thickness
Discharge gas: xenon – 33 kPa pressure
Discharge gap: 4.3 mm

[0065] In FIG. 19, the discharge current waveform Id(t) sharply rises in two points of the time Td1 and the time Td2. This shows that discharge started at the points. In the voltage waveform E(t), inflection points K1 and K2 are formed at respective points corresponding to the time Td1 and the time Td2, respectively. Among the two inflection points, although the inflection point K2 is relatively indistinct, the discharge current waveform Id(t) steeply rises at the time Td2, and thereby the inflection point can be distinguished. When the voltage waveform E(t) is viewed in more detail, inflections points K3 and K4 similar to the inflection point K2 are found at time Td3 and Td4, respectively. The discharge current waveform Id(t) also shows that discharge started at the points K3 and K4.

[0066] If the value of Vy/Vx is calculated based on the conditions recited in claim 1 of the present application, according to FIG. 19, the value Vy/Vx for the discharge started at the time Td1 can be calculated by using the values: Vf =Vk4, Vk =Vk1, Vb =Vb1, and Vh =Vh1. In the same manner, the value for the discharge started at the time Td2 can be calculated by using the values: Vf =Vh1, Vk =Vk2, Vb =Vk2, and Vh =Vh2. Further, the value for the discharge started at the time Td3 can be calculated by using the values: Vf =Vh2, Vk =0, Vb =0, and Vh =Vh2. The value for the discharge started at the time Td4 can be calculated by using the values: Vf =Vh3, Vk =Vk4, Vb =Vk4, and Vh =Vk4. However, if contribution of each of the four discharge points to the whole discharge is judged from the area defined by the discharge current waveform Id(t) and the straight line of Id = 0, the main discharge which substantially controls the efficiency is regarded as the discharge started at the time Td2, thus the other discharge points can be disregarded. Therefore, the value "Vy/Vx = 0.32" is obtained for the whole of the waveform.